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## **The impact of COVID-19 stay-at-home orders on health behaviors in adults**

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**1. What is already known about this subject?**

- COVID-19 rapidly spread across the globe and is disproportionally affecting individuals with underlying chronic health conditions such as obesity.

**2. What are the new findings in this study?**

- Stay-at-home orders have resulted in overall changes to dietary behaviors, increases in sedentary behaviors alongside decreases in physical activity, and declines in mental health.
- Overall, scores for healthy eating increased. People with obesity report being differentially affected, showing both greatest improvements to unhealthful dietary behaviors, as well as the sharpest declines in mental health and the highest incidence of weight gain as a result of stay-at-home orders.

**3. How might these results change the direction of research or the focus of clinical practice?**

- Increased mental health screenings will be necessary for patients with obesity throughout and following the COVID-19 pandemic.
- Individuals with obesity may be uncomfortable attending in-person care appointments due to concern of the virus. Therefore, it is important for these individuals to remain connected through remote medicine and telehealth in order to prevent irreversible health effects caused by the pandemic.

## Abstract

**Objective:** Stay-at-home orders in response to the COVID-19 pandemic have forced abrupt changes to daily routines. This study assessed lifestyle changes across different BMI classifications in response to the global pandemic.

**Methods:** The online survey targeting adults was distributed in April 2020 and collected information on dietary behaviors, physical activity, and mental health. All questions were presented as “before” and “since” the COVID-19 pandemic.

**Results:** In total, 7,753 participants were included. The sample included 32.2% of individuals with normal weight, 32.1% overweight, and 34.0% had obesity. During the pandemic, overall scores for healthy eating increased ( $p<0.001$ ), due to less eating out and increased cooking ( $p<0.001$ ). Sedentary leisure behaviors increased while time spent in physical activity (absolute time and intensity-adjusted) declined ( $p<0.001$ ). Anxiety scores increased  $8.78\pm0.21$  during the pandemic and the magnitude of increase was significantly greater in people with obesity ( $p\leq0.01$ ). Weight gain was reported in 27.5% of the total sample compared to 33.4% in participants with obesity.

**Conclusions:** The COVID-19 pandemic produced significant health effects, well beyond the virus itself. Government mandates together with fear of contracting the virus have significantly impacted lifestyle behaviors alongside declines in mental health. These deleterious impacts have disproportionately affected individuals with obesity.

## Introduction

The recently discovered severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), resulting in COVID-19 infection, is a serious threat to public health. In response to the global outbreak, a wave of quarantine and stay-at-home mandates were issued to attenuate the rapid worldwide spread.

Stay-at-home orders have curbed the spread of the virus, [1] yet the results of these unprecedented government mandates on other indices of health cannot be overlooked. Temporary closure to places of employment, restaurants, fitness facilities, and other public places forces abrupt changes to habitual dietary and physical activity patterns. Furthermore, social isolation has deleterious impacts on mental wellness [2]. Stress is associated with sleep disruption, consumption of highly palatable foods, and increased snacking, often resulting in weight gain [3]. Non-scientific reports have begun to illustrate the impacts of weight gain throughout the pandemic. The COVID-19 pandemic therefore has the potential to also threaten non-communicable diseases such as obesity.

To assess the widespread impacts of the COVID-19 pandemic on health behaviors, the aim of this study was to quantify changes in habitual dietary behaviors, physical activity, sleep, sedentary behaviors, and mental health before and during the initial peak of the COVID-19 pandemic. We hypothesized that the closure of restaurants and businesses and restriction to movements would be commensurate with improved diet quality and declines in physical activity and mental health.

## Methods

### *Study design*

This study was approved by the Institutional Review Board at Pennington Biomedical Research Center, and adults 18 years of age or older with access to the internet were eligible to participate. The study was open between April 3, 2020 to May 3, 2020. Participants responded to a link to the anonymous survey via paid advertisements on the social media platform Facebook (California, US). Paid advertisements first broadly targeted the United States, Australia, Canada, Ireland, and the United Kingdom. A second set of paid advertisements aimed to increase diversity of survey respondents and were published in Chicago, IL, Detroit, MI, New York, NY, Philadelphia, PA,

Houston, TX and greater Alabama, California, Florida, Georgia, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, and Virginia. In addition, the survey was posted on the research center webpage, and distributed via an email listserv and word of mouth. Upon entering the survey link, interested individuals received instructions that detailed the purpose of the study and after verifying they were adults, provided consent to participate. Deidentified data were collected using REDCap (Research Electronic Data Capture) [4]. Participation in the survey was voluntary and no compensation was provided.

### *Survey design and study outcomes*

The survey captured information across five domains: demographics and household information, sedentary behaviors, physical activity, diet, sleep, and mental health. All data was self-reported using a combination of validated questionnaires with minor modifications together with investigator-created questions unique to the survey aims and pandemic. Body mass index (BMI) for each participant was calculated from self-reported height and weight. To assess behaviors prior to the outbreak, participants were asked to recall their health behaviors using the phrase, “before to the COVID-19 outbreak in your country or region”. Behaviors during the pandemic were assessed sequentially by asking, “since the COVID-19 outbreak in your country or region”. Diet, physical activity, sedentary behaviors, and mental health domains included short form and long form instruments. Participants were required to complete the short form but could provide more detailed responses using the long form instrument if desired.

### *Diet behaviors and weight change*

To assess changes in dietary behaviors, the short form included items on cooking and eating out habits, and snacking prior to and during the pandemic. Perception of overall healthy eating habits and weight change was asked. The optional long form was a modification of the Rapid Eating Assessment (REAP-s) [5]. Participants were asked the frequency of engaging in eight unhealthful dietary behaviors for an average week before the COVID-19 outbreak and again for behaviors since the COVID-19 outbreak. The topics included the following: breakfast skipping, consuming less than two fruits and vegetables per day, eating four or more meals from a sit-down or takeout restaurant, fast

food two or more times, and eating fried foods, sweets and desserts, or drinking more than 16 ounces of sugar sweetened beverages. Answer choices included usually/often, sometimes, or rarely/never, which were assigned numerical values of one, two, and three, respectively. Scores ranged from eight to 24, with a higher cumulative score indicative of a healthier diet.

#### *Sedentary and physical activity*

For sedentary activity, changes in sedentary leisure behaviors (such as watching television, using the phone for entertainment, and playing video games) on weekdays and weekend days was assessed.

Answer choices for sedentary behaviors were the following: zero to one hour, one to two hours, two to four hours, and greater than five hours and were analyzed by using the mean value of the given range (ie. 30, 90, 180, and 300 minutes, respectively). Due to an unrecognized error in the published survey, the short form physical activity questionnaire was unusable. Therefore, physical activity was reported through the long form; a 12-item physical activity questionnaire modified from the Nurses' Health Study Physical Activity Questionnaire [6]. Metabolic equivalents (METs) for physical activities from the survey were chosen from the Compendium of Physical Activities [7]. Intensity-adjusted physical activity was computed by multiplying the time spent in each activity by the corresponding MET value.

#### *Mental health & sleep*

Mental health was assessed through two questions regarding health concerns for the virus and the long form additionally utilized a 7-item anxiety scale (GAD-7) [8]. The final item on the GAD-7 assessed symptomatic anxiety, defined as if anxiety symptoms affected work, daily life, and ability to get along with other people. Sleep onset and wake times before and during COVID-19 were presented as time in hours and minutes in five minute increments. The specific survey domains are registered and available to the public at PhenX Toolkit (<https://www.phenxtoolkit.org/covid19>) [9].

#### *Statistical analysis*

For inclusion in the analysis, participants were required to complete a minimum of one COVID-19 question, which were presented immediately following demographics and household information.

Means were used for scoring categorical questions when a range of time was provided as an answer choice. Survey domains were presented as demographics, sedentary behaviors, physical activity, diet, mental health, and sleep. The primary analysis required paired-samples (pre and post COVID-19 responses) for each of the domains.

Descriptive statistics (means, frequencies, and percentage of sample) were used for demographic data and are presented as mean  $\pm$  SEM or frequency (percent). Continuous variables were analyzed using paired sample t-tests, while categorical outcomes were assessed through chi-squared tests of association. Differences between BMI groups (normal weight, overweight, and obesity) for baseline and change scores were assessed using least squared means from a mixed effect linear model. All analyses were set as  $\alpha \leq 0.05$  as the predetermined level of significance. Data are presented as mean  $\pm$  SEM.

## Results

### *Demographics*

In total, 12,476 individuals provided consent and 7,753 completed the first COVID-19 question, and were therefore included in the analysis (Figure 1). Individuals primarily resided in the United States (n=4,890), United Kingdom (n=1,839), Australia (n=497), and Canada (n=154) which together comprised 95.2% of the sample. From the United States, the most reported states of residence were Louisiana, California, and Florida. The majority of participants were female (80.0%), white (89.6%), and lived in a two-person household (42.2%). The average age was  $51.2 \pm 0.17$  years with an average BMI of  $28.6 \pm 0.09$  kg/m<sup>2</sup>. Approximately one-third of the participants had normal weight (32.2%), overweight (32.1%), and obesity (34.0%). Responses for pre-COVID 19 behaviors and behaviors during the stay-at-home orders for diet, sedentary behaviors, physical activity, mental health, and sleep are presented in Table 1.

### *Dietary and physical activity patterns*

Eating behaviors were significantly changed with COVID-19 (Figure 2a). Eating meals from restaurants and consuming pre-prepared food declined from 1.98 times per week to 1.08 times per week ( $p < 0.001$ ), while cooking meals at home increased from 4.49 to 5.18 days per week ( $p < 0.001$ ).

The REAP-s increased ( $0.81 \pm 0.04$ ,  $p < 0.001$ ), indicating overall healthier eating. Positive reported eating behavior changes included less frequency of breakfast skipping, eating four or more meals at a restaurant and two or more meals from fast food, consumption of fried foods, and an increased frequency of eating fruit. Reported negative eating behavior changes included increased consumption of sweets and sugar sweetened beverages. There were no reported differences in vegetable intake from before to during the pandemic. An increase in healthy snacking was reported by 25.8% of participants, whereas 43.5% reported an increase in unhealthy snacking. Overall, 20.7% perceived they were eating healthier and 35.6% reported eating less healthy. A perceived shift towards unhealthy eating was accompanied by increases in sedentary behaviors, declines in physical activity, a later sleep onset time, and nearly twice the increase in reported anxiety compared to those eating healthier. For participants who reported healthier eating behaviors, physical activity increased and percentage of participants working from home as a result of COVID-19 was greatest. Participant characteristics for reported eating behavior changes are presented in Table 2.

Leisure sedentary activities, increased by  $16.83 \pm 0.84$  ( $p < 0.001$ ) and  $21.25 \pm 0.90$  minutes ( $p < 0.001$ ) on weekend days and week days, respectively. Mean reported leisure sedentary behaviors on weekdays were  $169.55 \pm 1.16$  minutes per day prior to the pandemic and  $190.79 \pm 1.15$  minutes during the pandemic. For weekend days,  $194.84 \pm 1.56$  minutes per day were spent in sedentary leisure behaviors which rose to  $211.66 \pm 1.11$  minutes during the pandemic. Mean reported physical activity levels prior to the pandemic were  $348.06 \pm 6.09$  minutes per week ( $1453.40 \pm 29.96$  MET minutes) and  $329.74 \pm 6.19$  minutes per week ( $1341.52 \pm 29.80$  MET minutes) during. Physical activity (Figure 2b-c) declined  $18.32 \pm 4.63$  minutes per week and after accounting for exercise intensity, declined by  $111.88 \pm 22.07$  weekly MET minutes (both  $p < 0.001$ ).

#### *Sleep and mental health*

Sleep onset and wake time significantly changed (onset:  $42.41 \pm 1.61$  and wake:  $59.33 \pm 2.15$  minutes later, both  $p < 0.001$ ). Changes to sleep quality varied, 43.8% reported worsened sleep quality while 10.2% reported improved sleep quality.

Most participants reported being concerned or moderately concerned for their own physical health (75.0%) or the health of a family member (87.5%) as it relates to COVID-19. Overall anxiety significantly increased ( $8.78 \pm 0.21$ ,  $p < 0.001$ ) and 20% of participants reported symptomatic anxiety, an increase of 14% compared to before the pandemic.

*Change specific to individuals with obesity*

The COVID-19 pandemic disproportionately affected health behaviors of individuals with obesity (Figure 2a-2d). Prior to the pandemic, total REAP-s for individuals with obesity was  $17.41 \pm 0.09$  and with normal weight and overweight was  $18.95 \pm 0.09$  and  $18.50 \pm 0.09$ , respectively. With the government mandated stay-at-home orders, individuals with obesity had the largest increase to healthy eating behaviors ( $1.13 \pm 0.08$  compared to  $0.67 \pm 0.08$  and  $0.83 \pm 0.08$  for normal weight and overweight, respectively,  $p < 0.001$ ). These differences are likely driven by individuals with obesity reporting the lowest REAP-s score prior to the pandemic. Individual contributions to the overall REAP-s score by BMI are presented in Figure 3. Despite individuals with obesity having lower physical activity than individuals with normal weight and overweight before the pandemic, the change in physical activity did not differ between BMI groups (both  $p > 0.05$ ).

There were no differences in wake time between BMI subgroups, however individuals with obesity had a greater change in sleep onset time than individuals with normal weight ( $8.72 \pm 0.07$  minutes later,  $p = 0.3$ ) and overweight ( $8.14 \pm 0.07$  minutes later,  $p = 0.04$ ). BMI-specific changes to mental health are shown in Figure 2d. Individuals with obesity reported significantly higher anxiety before the pandemic compared to participants with normal weight and overweight ( $10.43 \pm 0.31$  vs  $8.99 \pm 0.32$  and  $8.14 \pm 0.32$ , respectively  $p < 0.001$ ). Similarly, individuals with obesity experienced significant increases in anxiety compared to participants with normal weight and overweight ( $9.52 \pm 0.38$  vs  $7.88 \pm 0.40$  and  $8.14 \pm 0.40$ , respectively  $p < 0.001$ ). Symptomatic anxiety was not different between BMI subgroups before the pandemic ( $p = 0.06$ ), but it was significantly higher in participants with obesity (24%) compared to normal weight (17%) and overweight (17%) during ( $p < 0.001$ ).

During the stay-at-home orders, 27.3% of the sample reported weight gain and weight gain was more prevalent with obesity compared to overweight and normal weight (33.4% vs 20.5% and 24.7%, respectively  $p<0.001$ ). By contrast, 17.3% of participants reported losing weight which was consistent across BMI groups (obesity: 18.0%; overweight: 18.0%; normal weight: 17.8%). Respondents who reported weight gain had little changes in eating behaviors but demonstrated the largest declines in physical activity. Not surprisingly, those who reported weight loss had improvements in their health eating score, increases to physical activity, and a blunted increase in sedentary behaviors. Participant characteristics for reported weight changes are presented in Table 3.

## Discussion

This study is the first to survey thousands of people across the globe on lifestyle behavior changes in response to stay-at-home orders. Although the current survey does not capture diet composition per se, individuals reported a combination of positive and negative changes in eating behaviors. Declines in healthful eating behaviors were coincident with reductions in physical activity, and these negative behaviors were characteristic of individuals reporting weight gain in response to the pandemic outbreak.

Increased overall healthy eating scores were primarily due to the reduction in eating foods prepared outside the home – an almost unavoidable change to food intake that resulted from stay-at-home orders. This finding is confirmed by a report of HUNTER food and beverage communications who surveyed 1,005 individuals living in the United States and showed 54% of individuals reported cooking more frequently since the start of the pandemic [10]. Other positive dietary changes included a reduction in fried foods, which are generally a product of restaurant dining and fast food.

The reported decline in physical activity is supported by objective data from Fitbit, Inc, which showed that the monitor data detected a 7-38% decline globally since the start of the pandemic [11]. Our study provides additional evidence that declines in physical activity are characterized by a shift towards lower intensity activities. The magnitude of change observed through our survey is comparable to

declines detected by Fitbit, Inc. Total minutes spent in physical activity declined by 6% and intensity-adjusted minutes declined by 8%, while time spent jogging and running, which are more easily detected by watch-worn activity monitors, declined by 13% and 10%, respectively. Leisure sedentary behaviors increased greater on weekdays compared to weekend days. These disproportionate increases could be attributed changes in structured workdays, time gained from ceasing a workplace commute, or to replace other forms of entertainment that would typically occur outside the home. Declines to physical activity were less for participants residing in the United States compared outside of the United States (Supplemental Table 1). However, these changes are likely contributed to overall lower levels of physical activity of participants residing in the United States prior to the pandemic.

Reported anxiety scores nearly doubled in response to the pandemic and 20% of the sample reported that symptoms were severe enough to interfere with daily routines. Increased anxiety has been observed after other extreme natural disasters [12, 13], highlighting the equivalent impact of the pandemic on mental health. The close relationships between anxiety, energy intake and food preference are a concern for future weight gain, particularly in individuals with obesity.

Survey studies are prone to the inherent limitations of self-reported data. While validated instruments were used as available, investigator-created questions were necessary to capture the current unique environment. At the start of the pandemic, the responses of different nations changed very rapidly. As a result, it was not possible to gather true pre-pandemic responses. Instead, participants were asked to recall pre-pandemic behaviors retrospectively, which was no more than one month prior than their current responses in most instances. Importantly because many of the responses to pre-pandemic behaviors significantly differed from perceived behaviors during COVID-19, we can assume that individuals recognize changes to their own behavior and emotions, to some extent. The delivery of the survey was intentionally set to capture behavioral changes in response to the initial phase of the pandemic, and at the time the study opened (April 3, 2020), 41 of the 50 US states were following a state-wide stay-at-home order. By April 8, three additional states (44 of 50) issued a statewide stay at home order. For the most represented countries outside the United States (e.g., Canada, the United Kingdom, Australia, and Ireland), large cities and capitol regions were all under government enforced

social distance or stay-at-home orders at the opening of this study. Using these guidelines, 95.6% of the sample were affected by government mandates to control the spread of the virus. It is important to note that despite targeted recruitment strategies aimed to attract a diverse population, there is potential bias in our sample. The majority of participants are individuals identifying as white, women, older adults, and with a large proportion from similar geographic regions. The overwhelming response from women could be due to several factors. First, a higher proportion of Facebook users are women, which was our primary source of advertisement. Second, women were disproportionately affected by unemployment in response to the pandemic and could have had greater availability to respond to the survey. The findings of the entire study sample did not differ from a subsample restricted to the United States alone. This provides evidence that behavioral and emotional changes in response to the COVID-19 pandemic are indeed of global concern.

As individuals across the globe became confined to their homes, daily work and household responsibilities shifted. These abrupt changes resulted in mental health declines alongside some positive and many negative changes to health behaviors. The behavior changes likely facilitated weight loss or weight gain, and individual weight change is due to the extent to which people experienced greater change in one domain (e.g., food intake) vs. another domain (e.g., exercise). Among those who gained weight, COVID-19 symptoms could be more severe, should they contract the disease, resulting in worse outcomes. With increased cases of weight gain and significant declines to mental health, COVID-19 may impact clinical practice for years to come.

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**Figure 1.** Consort diagram of the survey responses.

**Figure 2.** Overall changes to **a.** dietary behaviors (REAP-s), **b.** time spent in physical activity (absolute minutes) and **c.** time spent in physical activity (intensity adjusted), and **d.** anxiety (GAD-7 score) for the total sample and each BMI subgroup. Data are presented as mean  $\pm$  SEM and \* denotes a significant difference between pre (black bar) and during April 2020 (grey bar) the COVID-19 pandemic.

**Figure 3.** Changes in individual contributors to the overall REAP-s score. A positive change is indicative of a healthier REAP-s score. Data are presented as mean  $\pm$  SEM.

Table 1. Outcome variables from the Pennington Biomedical COVID-19 Health Behaviors Survey for pre-COVID 19 behaviors and behaviors during the stay-at-home orders

Outcome	n	Pre	During	p
<b>Dietary Behaviors Short Form</b>				
Eating meals from restaurants or consuming prepared food ( <i>n</i> )	5362	2.0±0.0	1.1±0.0	<0.001
Cooking dinners at home ( <i>n</i> )	5360	4.5±0.0	5.2±0.0	<0.001
<b>Dietary Behaviors Long Form</b>				
REAP-s Total ( <i>score</i> )	4071	18.3±0.1	19.1±0.0	<0.001
Frequency of breakfast skipping ( <i>score</i> )	4066	2.2±0.0	2.3±0.0	<0.001
Frequency of eating four or meals from a restaurant ( <i>score</i> )	4066	2.5±0.0	2.8±0.0	<0.001
Frequency of eating two or more meals from fast food ( <i>score</i> )	4065	2.5±0.0	2.7±0.0	<0.001
Frequency of eating of fried foods ( <i>score</i> )	4062	2.3±0.0	2.5±0.0	<0.001
Frequency of drinking sugar sweetened beverages ( <i>score</i> )	4063	2.3±0.0	2.4±0.0	0.0004
Frequency of eating sweets or desserts ( <i>score</i> )	4063	2.0±0.0	1.9±0.0	<0.001
Frequency eating less than two servings of fruit per day ( <i>score</i> )	4067	2.0±0.0	2.1±0.7	<0.001
Frequency eating less than two servings of vegetables per day ( <i>score</i> )	4067	2.2±0.0	2.3±0.7	0.42
<b>Sedentary Activity</b>				
Sedentary activity on weekend days ( <i>minutes</i> )	6076	194.8±1.2	211.7±1.1	<0.001
Sedentary activity on week days ( <i>minutes</i> )	6096	169.5±1.2	190.8±1.1	<0.001
<b>Physical Activity</b>				
Physical activity ( <i>minutes</i> )	4376	348.1±6.1	329.7±6.2	<0.001
Physical Activity ( <i>intensity adjusted minutes</i> )	4376	1453.4±30.0	1341.5±29.8	<0.001
<b>Sleep</b>				
Sleep onset ( <i>time ± minutes</i> )	4987	10:44±0:02	11:26±0:02	<0.001
Sleep wake ( <i>time ± minutes</i> )	4987	6:54±0:01	7:53±0:02	<0.001
<b>Mental Health</b>				
Generalized anxiety disorder (GAD)-7 ( <i>score</i> )	4012	10.1±0.8	18.8±0.2	<0.001

Table 2. Participant characteristics of reported change in eating behaviors

	Less Healthy (n=1909)	More Healthy (n=1110)	No Change (n=2337)	<i>p</i>
Sex				<0.001
Males (%)	27.2	21.9	51.6	
Females (%)	37.8	18.6	44.6	
Race				
White (%)	35.3	20.4	44.4	0.02
Other (%)	38.8	23.5	37.6	
Country				0.03
US (%)	35.0	21.8	43.2	
Other (%)	36.8	18.6	44.6	
Working from home due to COVID-19 (%)	29.9	38.5	28.6	<0.001
Laid off due to COVID-19 (%)	17.4	16.3	12.5	<0.001
Change to REAP-s (total score)	-0.23±0.07	2.58±0.08	0.78±0.06	<0.001
Change in PA (mins)	-63.27±7.83	41.43±10.24	-7.12±7.17	<0.001
Change in PA (intensity adjusted mins)	-286.49±37.36	138.11±48.89	-73.73±34.20	<0.001
Change to sedentary behaviors (mins per weekday)	27.22±1.75	22.35±2.10	15.26±1.33	<0.001
Change to sedentary behaviors (mins per weekend day)	22.66±1.61	15.0±1.92	12.58±1.25	<0.001
Change in sleep onset (mins)	60.53±2.83	41.30±3.69	28.22±2.22	<0.001
Change in sleep wake (mins)	67.26±3.62	64.84±4.50	50.27±3.29	0.001
Change in GAD-7 anxiety score	13.04±0.38	7.71±0.47	5.77±0.28	<0.001

Participant characteristics for respondent who reported eating Less Healthy, More Healthy, and no change in health quality of diet from the start of the COVID-19 pandemic. *P* value denotes overall difference between three groups.

Table 3. Participant characteristics of reported change in weight

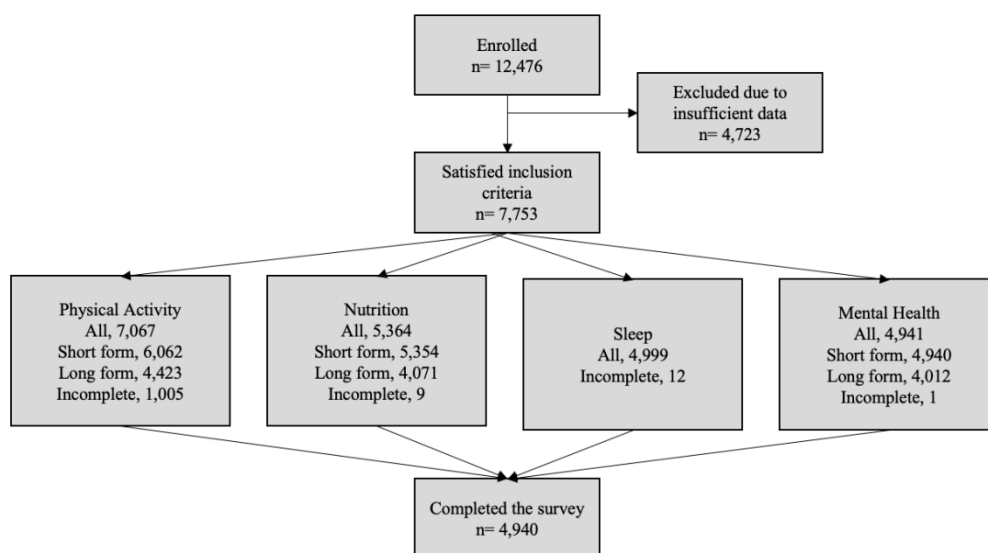
	Gained weight (n=1461)	Lost weight (n=928)	Stayed the same (n=2430)	Did not notice (n=535)	<i>p</i>
Sex					<0.001
Males (%)	20.5	19.0	50.4	10.1	
Females (%)	29.0	16.9	44.2	9.9	
Race					0.28
White (%)	27.1	17.1	45.8	10.1	
Other (%)	28.9	19.4	42.4	9.3	
Country					<0.001
US (%)	24.4	18.8	47.8	9.0	
Other (%)	33.6	24.4	39.8	12.6	
Working from home due to COVID-19 (%)	29.5	34.3	32.0	25.6	<0.001
Laid off due to COVID-19 (%)	19.4	15.6	12.1	15.5	<0.001
Change to REAP-s (total score)	0.00±0.08	1.83±0.10	0.91±0.06	0.77±0.14	<0.001
Change in PA (mins)	-70.76±9.01	24.54±11.20	3.58±6.93	-42.3±15.56	<0.001
Change in PA (intensity adjusted mins)	-322.89±42.98	55.59±53.43	-12.00±33.08	-243.7±74.23	<0.001
Change to sedentary behaviors (mins per weekday)	27.6±1.99	21.95±2.32	16.85±1.31	19.29±3.18	<0.001
Change to sedentary behaviors (mins per weekend day)	21.58±1.88	15.55±2.13	14.44±1.24	15.64±2.73	0.009
Change in sleep onset (mins)	56.82±3.29	42.04±4.49	33.54±2.09	44.54±5.08	<0.001
Change in sleep wake (mins)	69.46±4.41	63.68±5.35	52.45±3.00	55.78±6.59	0.008
Change in GAD-7 anxiety score	12.37±0.45	9.32±0.54	6.52±0.28	8.12±0.69	<0.001

Participant characteristics for respondent who reported gained weight, lost weight, no change in weight and did not notice weight change from the start of the COVID-19 pandemic. *P* value denotes overall difference between four groups.

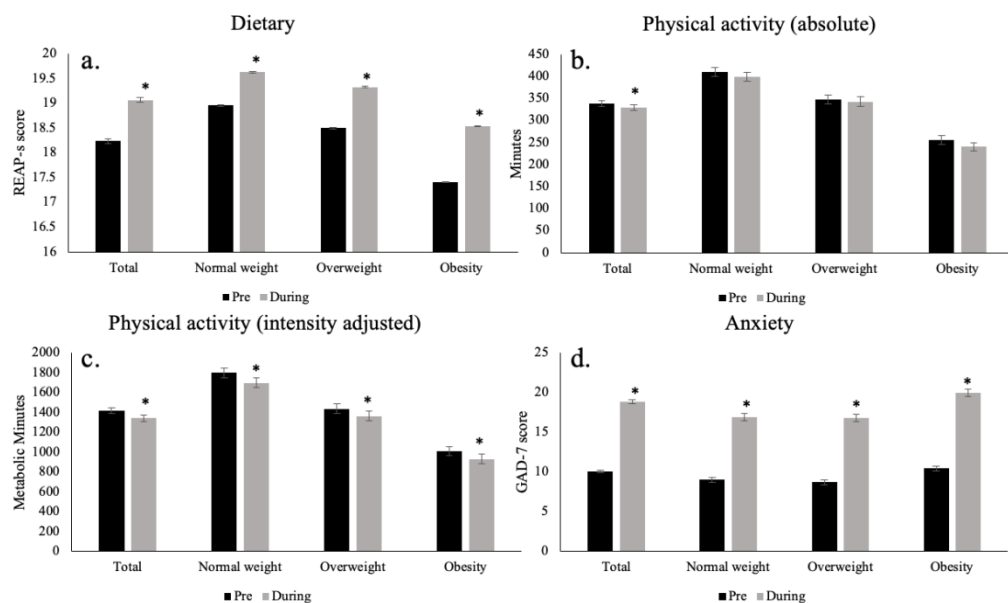
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